33rd Annual Conference of the Australasian Association for Engineering Education (AAEE 2022)
4 - 7 December 2022 – Sydney, NSW

Engagement and Empowerment of First-year Engineering Students Through A Passion-based Assignment

Ali Lalbakhsh[a,b,c]
[a] *Macquarie University College, Macquarie University, NSW 2109, Australia*
[b] *School of Engineering, Macquarie University, NSW 2109, Australia*
[c] *School of Electrical and Data Engineering, University of Technology Sydney (UTS), Sydney, NSW, Australia*

ali.lalbakhsh.mq.edu.au

ABSTRACT

CONTEXT

Effective oral and written communication is a critical competency expected from all engineering graduates by Engineers Australia. Hence, there are various assignments in engineering programs to improve this skill. However, it seems more challenging to engage first-year students in an engineering-related writing task fully. One of the main reasons for such a half-heartedly contribution, is poor understanding of academic integrity among the new comers combined with lack of ongoing feedback, leading to plagiarism and academic misconduct.

PURPOSE OR GOAL

This paper investigates the development of effective written communication skills in a Spine Unit (Introduction to Engineering) of engineering programs at Macquarie University College. The idea is to structure a versatile assignment based on each student's passion and provide the instructors with a crucial coaching guide associated with this comprehensive assignment, leading to a substantial reduction in plagiarism among the first-year students' submissions.

APPROACH

In this approach, students individually are to write a scientific report on a recent engineering marvel, something inspiring to them. There are four phases in implementing this assignment: 1-elective topic based on each student's preference supported by scaffolded research skills, 2- scaffolded academic writing techniques, 3-built-in teacher feedback, 4- built-in academic integrity reflection

OUTCOMES

This is a student-centred assignment with continuous feedback and coaching, occupying at least 25% of the tutorial time. The Role-Play model is used to allow students to assess the originality of their work, leading to a substantial reduction in plagiarism, and very high contribution and submission rate.

CONCLUSIONS

The proposed interactive assignment with the mentioned coaching qualities has been delivered to several cohorts at Macquarie University College, showing promising results in plagiarism reduction and high submission rate.

KEYWORDS

Effective communication, Academic integrity, Engineering Spine Units, Engagement, Empowerment

Introduction

First year is critical for engineering students:Tertiary education can significantly contribute to individual development, where its first year plays a formative role in this experience. However, there is a concern about first-year drop-out rates in many universities around the world, estimated at 16 % in Australia, 11% in the UK, and 25% in the USA, (Australian Government Department of Education, Skills and Employment (2019); Yorke and Longden 2006; ACT 2002;). Such an early drop-out negatively influences individuals, universities and societies (Tinto 2006, 2007; Bryson and Hand 2007). Research has suggested strong links between a student's first-year experiences and succeeding progression and success (Yorke and Longden 2007, 2008; Flores Juarez 2005;). Hence, one of the priorities of higher education is ensuring a high-quality learning curriculum in the first year of programs, encouraging research (Krause et al. 2005; AUSSE 2007-2008; Kuh 2008; Yorke and Longden 2008; NSSE 2001-2008;) and development (QAA 2006; Kift 2008).

Therefore, the first year of the engineering program is critical for student retention. It can also help students better understand their future careers through the first-year assignments, promoting engagement.

According to Bryson and Hand (2007), student engagement includes a dynamic interaction between the learning environment and the student. In a similar definition, Krause (2007) explains student engagement as the energy, resources and time students allocate for activities developed to enhance university learning. According to Krause's (2007) conclusion of a comprehensive survey on Australian undergraduates, engaged students with university life have a higher chance of achieving greater success and being motivated to persist in their course of study.

In addition to engaging new students, it is also critical to assist them in establishing ways they think about the world (Bovill, Bulley, and Morss 2011). Students need to embrace increased autonomy, independence, and critical thinking within their education. This can be umbrellaed by the term 'empowerment' described by Piper (2006) as a transformational process of enhancing control and ownership of the learning process. Indeed, control and choice in learning result in greater motivation, as the links between engagement and empowerment were found by Chan (2001).

The results of Bryson's study of perceptions of 50 students in the United Kingdom also confirm the existence of such links (Bryson and Hand 2007). In spite of all improvements, there is still scope for enhancing new (first-year) student engagement and empowerment. A great number of strategies have been proposed, such as interventions and strategic curriculum design to encourage students in active learning. A comprehensive survey of more than 5000 academic staff and 6500 students in the United States exhibited links between students' perceptions of academic competence and first-year curriculum coherence as reported by staff (Reason, Terenzini, and Domingo 2005). Juarez conducted a qualitative study in Mexico highlighting the effects on first-year student engagement, such as assessment and timetabling, in the curriculum (Flores Juarez 2005). The literature suggests interactive assignments and curriculum are vital drivers to enhance student engagement, leading to success from the first year onwards. Additionally, there is an increasing interest in improving choice and ownership, leading to empowerment (Piper 2006), which can be achieved by student participation in curriculum development (Bovill, Morss, and Bulley 2009).

This paper presents a highly-tailored assignment (passion-based assignment hereafter) for first-year engineering students to foster engagement towards empowerment. We present our methodology and explore its influence on students' engagement using data extracted from Macquarie University Learning Management System, "iLearn". According to the data, the inclusion of students' preferences in developing assignments can significantly increase students' engagement, reflected in plagiarism-free submissions and a very high submission rate leading to empowerment and promoting self-directed learning.

Methodology

The Passion-based assignment is developed to enhance engineering students' academic writing skills in a real-life engineering problem context. The assignment is worth 20% of Introduction to Engineering, an entry unit of the Engineering program at Macquarie University College, which is compulsory for all engineering students. The learning outcomes of this assignment are:

1- Advanced written communication skills in the context of engineering problems
2- Advanced understanding of academic integrity and its application in the context of engineering problems
3- Advanced self-directed learning skills

These learning outcomes align with Stage 1 competencies defined by Engineers Australia and help students develop these competencies at the beginning of their tertiary education and benefit from them. The design methodology of the proposed assignment contains four major steps as follows:

Elective topic based on each student's preference supported by scaffolded research skills

Introduction to Engineering is the most diverse cohort in the engineering program at Macquarie University College. While diversity is always welcome, it brings more challenges in designing assignments suitable and engaging for students from different majors. The proposed approach allows students to select a topic for their Passion-based assignment to address this challenge. This assignment is indeed an engineering report on one of the recent engineering marvels. However, there are some constraints on the topic that each student can choose. First, students nominate up to 10 engineering achievements in the last 20 years as their topic. The only constraint to choosing these potential topics is their passion and preference, where students need to be genuinely passionate and excited about the topic. The second step is shortlisting five topics that are more relevant to each student's major. In the third step, students are briefed on research strategies, such as 4S Systems (sherlinjohn, 2018) and Reliability Tests (Myhre, S.K. 2012), to rank their potential topics based on the availability and reliability of the information and consult with the instructor (teacher/tutor/lecturer) to choose the final topic. Finally, they need to write a reflection justifying their topic, where they need to answer the following questions:

1- How are they passionate about the topic?
2- How did they apply research skills in the ranking of their topics?
3- How relevant is the topic to their majors?
4- How are they confident about the availability of data for the completion of their reports?

Scaffolded academic writing techniques

In the previous step, students have already finalized their topic and also acquired some sources on their topic. In this step, they are briefed on one aspect of academic writing in each 2-hour lesson and then apply it to their reports. For example, the instructor explains academic voices in one lesson; students use indirect, external voices in some parts of their reports and receive feedback, all in one session.

Built-in teacher feedback

As a part of the assignment, students need to get the instructor's feedback and implement it in the report. This means they cannot complete their reports unless they show that they have received feedback and applied it. Additionally, such a built-in feedback mechanism helps the teaching team keep track of student progress, resulting in higher quality assurance, especially in large cohorts with multiple instructors involved.

Built-in academic integrity reflection

This assignment is designed to promote academic integrity by allowing students to assess the originality of their work through Turnitin. Turnitin is online text-matching software that compares submitted papers to databases of academic publications as well as other papers that have been submitted. In this assignment, students are to submit their work to Turnitin two days prior to the assignment due date to get their work similarity report. Indeed, Role-Play approach is used (Ampatuan, and San Jose. 2016), in which students play the assessor in assessing the originality of their work and provide recommendations accordingly. As a result, they have a chance to remove potential plagiarism. Finally, they need to write a reflection as a part of the assignment and elaborate on the strategies they used to minimize plagiarism.

Results

Implementing this new assignment has significantly enhanced students' academic integrity, leading to a noticeable reduction in the overall plagiarism rate over several deliveries. The medians of the similarity percentage over 7 deliveries since mid-2019 are presented in Fig. 1. The average of each class is shown in Fig. 2 for the same period. As can be seen, the average and median of each class similarity in the students' reports are around 40% for Term 4-2019 and Term 5-2019 (before introducing Passion-based assignment). The introduction of the proposed assignment and its interactive delivery method in Term 1-2020 has considerably reduced the similarity percentage to half (from 40% to less than 20%). This promising trend has continued over the next deliveries and reached a plateau of less than 5%, eliminating plagiarism among this cohort of first-year students.

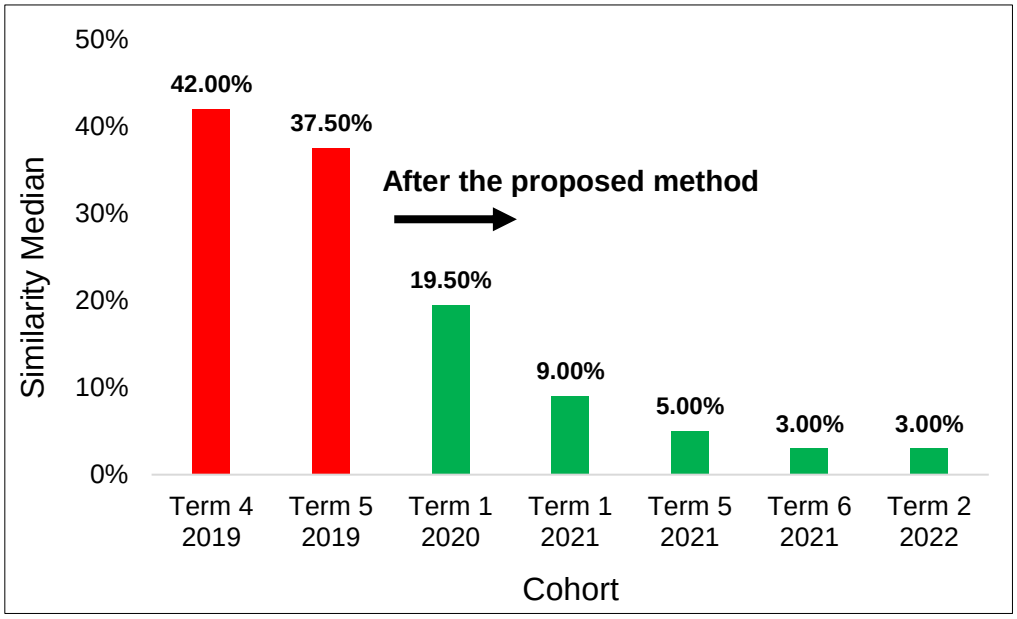

Figure 1: Similarity median across seven cohorts.

To provide a better insight into how the presented assignment improve each student's work, the normal distribution of similarity percentages of the two largest cohorts before and after the new assignment are presented in Fig. 3. As can be seen in this figure, before the new assignment, there was a large number of submissions with a very high similarity percentage (above 50%), where 21% of submissions have an extremely high similarity percentage of greater than 60%. As evident, the presented assignment successfully avoids high similarity percentages, where there is no submission with a similarity percentage greater than 20% in Term 1-2021, as opposed to 79% of submissions in Term 4-2019.

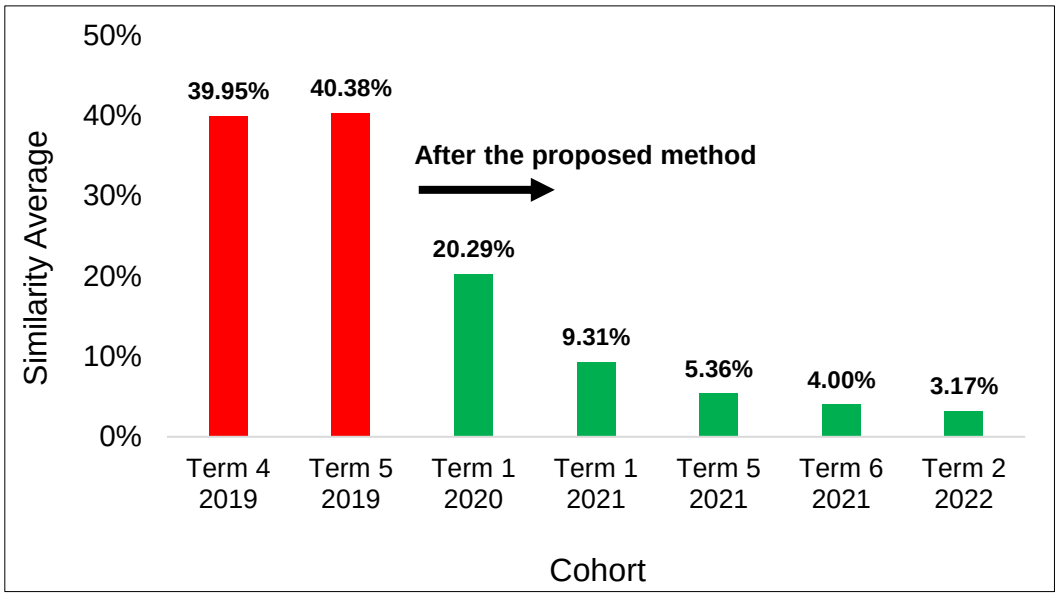

Figure 2: Similarity average across seven cohorts.

As a result of the built-in feedback and inclusion of students' preferences in the assessment structure, almost all students manage to submit their work on time, as shown in Table 1. Additionally, the assignment has contributed to a very high and sustained attendance rate.

Table 1: Submission rate of the passion-based assignment, attendance rate

	Term 1 2020	Term 1 2021	Term 5 2021	Term 6 2021	Term 2 2022
Submission rate	100%	100%	100%	80%	100%
Attendance rate	93%	92%	78%	78%	91%

Note: Only students who attempted the final exam are considered in this study

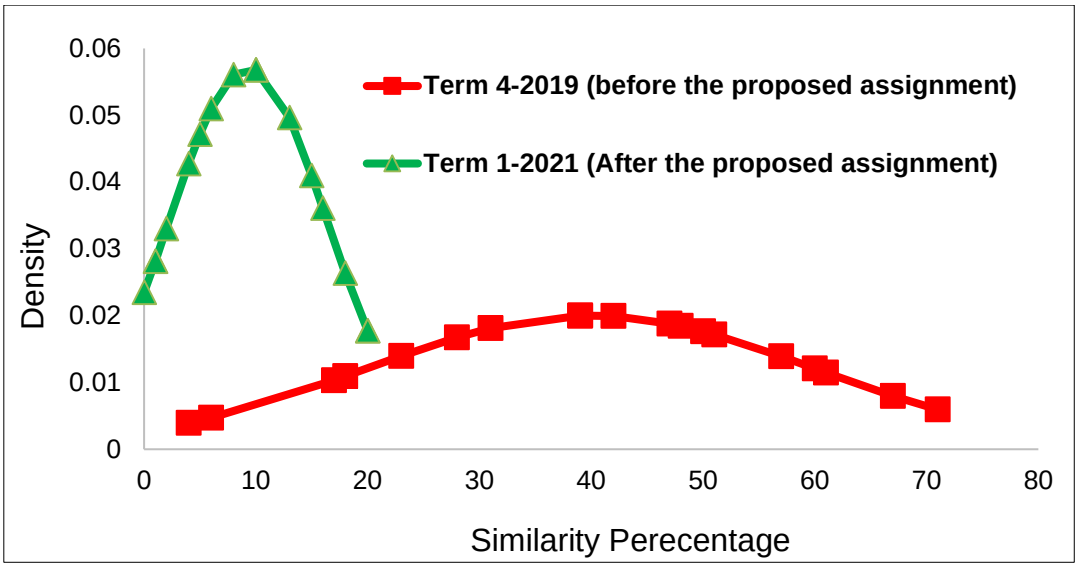

Figure 3: Normal distribution of similarity percentage of two cohorts.

Conclusion

We propose a highly interactive assignment for first-year units in the Engineering programs (Bachelor or Diploma). The proposed assignment is centred on each student's preference and includes built-in instructor feedback and students' reflections on academic integrity. This study reiterates the positive influences on students' performance in student co-designed curriculum, showing a significant enhancement on the originality of students work.

References

Ampatuan, R.A. and San Jose, A.E. (2016). Role play as an approach in developing students' communicative competence. *International Journal for Innovation Education and Research*, *4*(1), pp.18-24

AUSSE. (2007-2008). Australasian Survey of Student Engagement Reports. http://www.acer.edu.au/ausse/

Australian Government Department of Education, Skills and Employment. (2019). Factors Affecting Higher Education Completions, Department of Education, Skills and Employment.

Bovill, C., K. Morss, and C. Bulley. (2009). Should students participate in curriculum design?Discussion arising from a first year curriculum design project and a literature review.

Pedagogical Research in Maximising Education 3, no. 2: 17_26. http://www.hope.ac.uk/learningandteaching/downloads/prime/prime_vol_3_issue_2.pdf

Bovill, C., Bulley, C.J. and Morss, K. (2011). Engaging and empowering first-year students through curriculum design: perspectives from the literature. *Teaching in Higher Education*, *16*(2), pp.197-209.

Bryson, C., and L. Hand. (2007). The role of engagement in inspiring teaching and learning. Innovations in Education and Teaching International 44: 349_62.

Chan, V. (2001). Learning autonomously: the learners' perspectives. Journal of Further and Higher Education 25: 285_300.

Flores Juarez, J.B. (2005). Promoting student success: Students' perceptions of the factors that influence their engagement at a Mexican university. PhD diss., University of Texas at Austin. http://repositories.lib.utexas.edu/handle/2152/154

Kift, S., and K. Nelson. (2005). Beyond curriculum reform: Embedding the transition experience. http://www.herdsa.org.au/wp-content/uploads/conference/2005/pdf/refereed/paper_294.Pdf

Krause, K. (2007). New perspectives on engaging first year students in learning. http://www. enhancementthemes.ac.uk/documents/events/20070308/FYE_Engagement_Krause.pdf

Krause, K., R. Hartley, R. James, and McInnis, C. (2005). The first year experience in Australian universities: Findings from a decade of national studies. Canberra: Australian DEST. http://aegir-1.itc.griffith.edu.au/__data/assets/pdf_file/0006/37491/FYEReport05.pdf.

Kuh, G.D. (2008). High-impact educational practices: What they are, who has access to them, and why they matter. Washington, DC: Association of American Colleges and Universities.

Myhre, S.K. (2012). Using the CRAAP test to evaluate websites. PowerPoint presented at the 17th Annual Technology, Colleges, and Community Worldwide Online Conference

NSSE. (2001_2008). National Survey of Student Engagement. http://nsse.iub.edu/html/annual_ reports.cfm

Piper, R. (2006). Enhancing the student experience in Scotland _ the work of the QAA Quality

Enhancement Theme. Paper presented at the meeting of the Higher Education Academy, in Edinburgh.

QAA (Scotland). (2006). The first year. http://www.enhancementthemes.ac.uk/themes/FirstYear/ default.asp

Reason, R., P. Terenzini, and R. Domingo. (2005). First things first: Developing academic competence in the first year of college. Paper presented at the meeting of the Association for Institutional Research, 6 June, in San Diego.

sherlinjohn. (2018). Academic Integrity, Plagiarism and Critical Thinking, https://sherlinjohn.wordpress.com

Tinto, V. (2006. 2007). Research and practice of student retention: What next. Journal of College Student Retention. Research, Theory and Practice 8: 1_19.

Yorke, M., and Longden, B. (2006). The vital first year. Academy Exchange 4: 16_7.

Yorke, M., and Longden, B. (2007). The first-year experience of higher education in the UK:

Yorke, M., and Longden, B. (2008). The first-year experience of higher education in the UK. Final Report.London,UK:HEA.http://www.heacademy.ac.uk/assets/York/documents/resources/publications/FYEFinalReport.pdf

Copyright statement